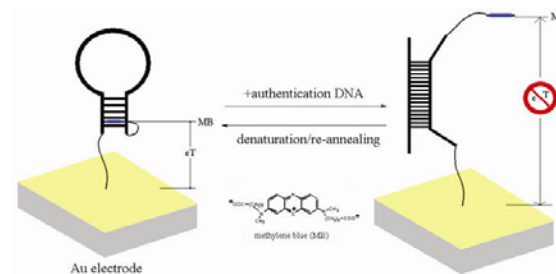


Electronic, DNA-based Authentication via the E-DNA Sensor

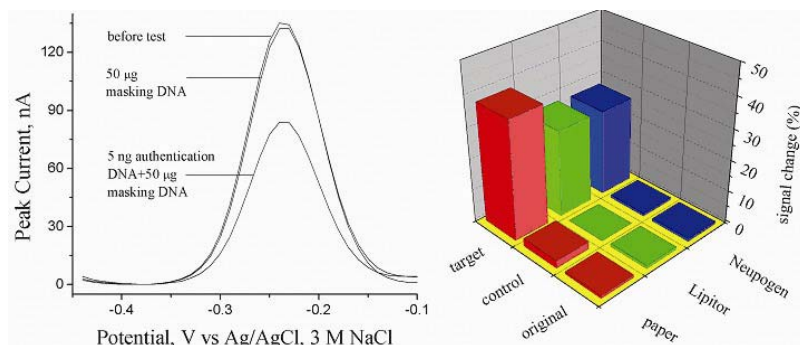
Chunhai Fan, Arica A Lubin, Kevin W Plaxco and Alan J Heeger

UC Santa Barbara, DMR-0099843

Recent, high profile examples ranging from the geopolitical to the medical illustrate the growing and increasingly complex risks associated with counterfeiting. We have demonstrated the applicability of a reagentless, electronic DNA sensor (E-DNA) to the problem of authentication. The E-DNA sensor can unambiguously detect nanograms of a specific oligonucleotide “authentication tag” even in the presence of a 10,000-fold excess of non-cognate “masking DNA”. Using an inexpensive electrochemical workstation, we obtain robust authentication signals via aqueous extraction of oligonucleotide tags from paper and an oral drug and via dilution of small aliquots of an injectable pharmaceutical all within minutes and without further processing.



In the absence of target, the stem-loop holds the MB tag in proximity to the electrode, thus ensuring efficient redox of the MB label. Upon hybridization with the target, electron transfer is turned off.



(Left) AC voltammograms for the E-DNA sensor before and after incubation with the salt water elutant from paper containing masking DNA (50 µg) or masking DNA (50 µg) plus the authentication tag (5 ng). (Right) comparison among the E-DNA signals before and after counterfeiting tests on filter paper, Lipitor and Neupogen samples.

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Education:

This is a clear example of interdisciplinary research. The collaboration involves a biochemist (Plaxco) and a physicist (Heeger) with a graduate student who matriculated in Chemistry (Lubin) and a post-doctoral researcher with expertise in electrochemistry.

Outreach:

The results described briefly above have just been submitted to Nature-Biotechnology for publication. We anticipate opportunities for technology transfer.